THE ELECTRICAL AND OPTICAL PROPERTIES OF IODINE DOPED AMORPHOUS CARBON THIN FILMS

HASNIZA BINTI ABD HAMID

FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA
MALAYSIA

ACKNOWLEDGEMENT

In the name of Allah, the Most Beneficent and Merciful, with the deepest gratefulness to Allah who has given me the strength and ability to complete this thesis.

First and the foremost, I would like to express my gratitude and most sincere appreciation towards my project supervisor and my co-supervisor, Puan Fakardellawarni binti Mohamad and Dr. Mohamad Rusop for her and his kind guidance, criticism, advices and support in complete this project.

I would also like to thanks to Puan Dayana Binti Kamaruzaman for her assistance and guidance towards my project.

My gratitude also goes to my beloved family member Encik Abd Hamid bin Hashim for advices, prayers, encouragement and continuous moral support for my study in Universiti Teknologi MARA.

Last but not least, thank you to my lecturer, friends and supporting staff's who have involved directly and indirectly in helping me to complete this thesis. The support and encouragement from all the people wills always be a pleasant memory throughout of my life.

Thank you very much and may God bless you always.

Hasniza binti Abd Hamid
Bachelor of Engineering (Hons) Electronic
Faculty of Electrical Engineering
Universiti Teknologi MARA
Shah Alam, Malaysia.

ABSTRACT

The aim in this project is to investigate the effect of amount of iodine doping on its electrical, optical and structural properties. This is important to investigate the optimum weight in order to fabricate the carbon based solar cell that could be used to solve the nonrenewable sources problem. In this project, the amorphous carbon (a-C) thin films have been deposited and doped by using Thermal Chemical Vapor Deposition (TCVD) techniques. The deposited a-C thin films have been doped at different amount of iodine in the fixed conditions. The effect of iodine amounts on the electrical and optical properties of iodine doped a-C thin films have been investigated using Current-Voltage (I-V) measurement, UV-Vis-NIR spectroscopy and Raman spectroscopy. In this project, the amorphous carbon (a-C) thin films have been deposited and doped by using Thermal Chemical Vapor Deposition (TCVD) techniques. The deposited a-C thin films have been doped at different amount of iodine in the fixed conditions. The effect of iodine amounts on the electrical and optical properties of iodine doped a-C thin films have been investigated using Current-Voltage (I-V) measurement, UV-Vis-NIR spectroscopy and Raman spectroscopy. As the amount of iodine increase, the conductivity increase while the optical bandgap decrease from 0.21 eV to 0.15 eV with iodine doping from 0 g to 2 g. Then the optical bandgap increase from 0.15 eV to 0.28 eV as the amount of iodine increase from 2 g to 5 g. This is due to increase of sp^2 bonded carbon configuration. The conductivity of the sample increases as the iodine doping increase from 0 g to 2 g. It also shows that iodine doped with 2 g were having the highest photoresponse that may due to neutralization of the dangling bonds. The Raman properties proved that the presences of sp^2 and sp^3 bonding in the samples.

ABBREVIATIONS

a-C	-	Amorphous carbon
TCVD	-	Thermal Chemical Deposition
N_2	-	Nitrogen
P	-	Phosphorus
I	-	Iodine
B	-	Boron
CVD	-	Chemical Vapor Deposition
a:DLC	-	Amorphous diamond carbon
C	-	carbon
$C_{10}H_{16}O$	-	Camphor
F1	-	Furnace 1
F2	-	Furnace 2
DLC	-	diamond-like carbon
MW	-	Microwave
SWP	-	surface wave plasma
DI	-	Deionized
Ar	-	Argon
Au	-	gold
I-V	-	current-voltage
FESEM	-	Field Emission Scanning Electron Microscope
AFM	-	Atomic Forces Microscopy

CHAPTER 1

INTRODUCTION

1.0 BACKGROUND OF STUDY

The increasing in world population and rapid increase of global population and beginning of modern era, the increasing in energy consumption and the essential for human being to dependent on energy. The conventional fossil fuels such as coal, oil and natural gas those are limited and nonrenewable. That make, the researchers tend to find the solution for this existing problem. Moreover, the used of these kinds of conventional fossil fuels has contributes to pollution and unpredictable problems. Therefore, in this thesis, the conceivable alternative is been considered. The solar cell is one of the alternative energy that is clean and renewable that is the main focus in this project. It is a semiconductor device that converts sunlight directly into electricity through the photovoltaic effect. However, the conventional solar cells that mostly on silicon based fabricated are very expensive. Therefore, in this research, the alternative material been used in order to replaced it.